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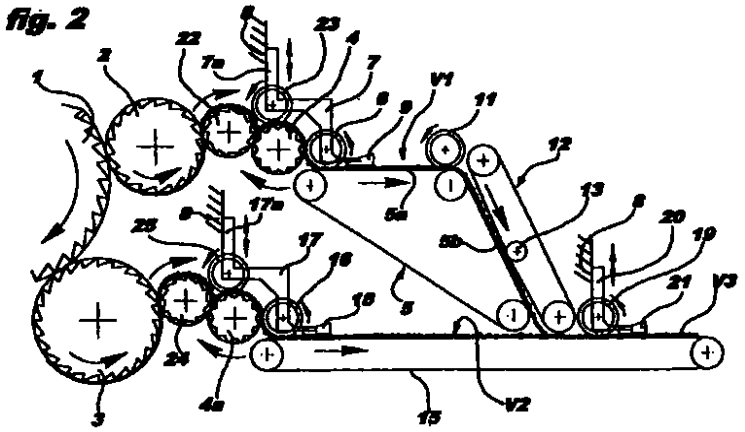
(54) "Carding apparatus, particularly for preparing webs for non-woven fabrics"

(57) Carding apparatus comprises a final swift (1) with which two output combing cylinders (2, 3) cooperate, the combing cylinders (2, 3) being situated at different heights and picking up an upper web of fibres (V_1) and a lower web of fibres (V_2), respectively. Each of these webs (V_1, V_2) is supplied, possibly with the interposition of a randomizer cylinder (22, 24) - to a respective doffer cylinder (4, 4a); the doffer cylinders (4, 4a) deposit the upper web (V_1) on an upper conveyor belt (5) having a downwardly-inclined final active portion (5b), and the lower web (V_2) on a lower, substantially horizontal conveyor belt (15) on which the upper web (V_1) is deposited by the above-mentioned inclined final portion of the upper conveyor in order to form a web (V_3) with two superimposed layers. At the critical points of the path of each web (V_1, V_2, V_3) at which - during high-speed operation - an undesired alteration in the orientation of the fibres may occur, there are control cylinders (6, 16, 11, 19, 23, 25) which have closely-packed peripheral sets of fins of limited height and which accompany and control the webs and convey the air-flows produced by the rotating members.

fig. 2



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Description

[0001] The present invention relates to carding apparatus, particularly for producing webs for non-woven fabrics, of the type comprising:

- two output combing cylinders disposed at different heights and cooperating with the final swift of the carding apparatus in order to pick up an upper web of fibres and a lower web of fibres, respectively,
- an upper doffer cylinder which supplies the upper web to an upper conveyor belt having a substantially horizontal initial active portion and a downwardly-inclined final active portion,
- a lower doffer cylinder which supplies the lower web to a substantially horizontal lower conveyor belt onto which the upper web is also supplied by the inclined active portion of the upper conveyor belt in order to be superimposed on the lower web.

[0002] A first object of the invention is to provide carding apparatus of the type defined above which can operate at high speed without giving rise to alterations in the web due, in particular, to the air-flows produced by the rotating members and to the resistance of the air to the forward movement of the web.

[0003] This object is achieved by means of the characteristics which form the subject of Claim 1.

[0004] A second object of the invention is to provide carding apparatus of the above-mentioned type in which fibre-randomizing means are interposed between each of the output combing cylinders and the respective doffer cylinder, and which can operate at high speed without giving rise to alterations in the web.

[0005] This second object is achieved by virtue of the characteristic which forms the subject of Claim 2.

[0006] Further advantageous characteristics of the invention form the subjects of Claims 3 to 13.

[0007] The invention will now be described with reference to the appended drawings, in which:

Figure 1 is a diagram of a first embodiment of the invention relating to the production of webs with fibres oriented parallel to the direction of advance,

Figure 2 is a diagram of a second embodiment of the invention relating to the production of webs with randomly-arranged fibres,

Figure 3 is a front elevational view of a finned control cylinder,

Figure 4 is a partial section through the cylinder of Figure 3, on an enlarged scale,

Figure 5 is a variant of the finned cylinder shown in Figure 3,

Figure 6 is a partial section through the cylinder of Figure 5, on an enlarged scale,

Figure 7 is a further variant of the finned cylinder shown in Figure 3,

Figure 8 is a partial section through the cylinder of Figure 7, on an enlarged scale,

Figure 9 is a schematic elevational view showing the means for adjusting the positions of the finned control cylinders,

Figure 10 is a partial perspective view of Figure 10, and

Figure 11 is an enlarged and partially exploded perspective view of a portion of Figure 10.

[0008] In the embodiment shown in Figure 1, the final swift of a carding apparatus rotates clockwise and is indicated 1, and two output combing cylinders, disposed at different heights and both rotating anticlockwise, are indicated 2 and 3. The upper combing cylinder 2 takes an upper web of fibres from the swift 1 and orients it parallel to the direction of advance. The combing cylinder 2 cooperates with a doffer cylinder 4 which rotates anticlockwise and has a peripheral velocity slightly greater than that of the combing cylinder 2. The clothing of the doffer cylinder 4 is "neutral", since it has isosceles triangular tips.

[0009] As shown in Figure 1, the fibres are transferred from the swift 1 to the conveyor 5 entirely on the lower portions of the combing cylinder 2 and of the doffer cylinder 4.

[0010] The doffer cylinder 4 releases an upper web V_1 of fibres oriented parallel to the direction of advance onto the initial active portion 5a of a conveyor belt 5 having a final active portion 5b which is inclined steeply downwards.

[0011] A control cylinder 6 having a closely-packed set of peripheral fins acts on the web supplied to the input of the initial portion 5a immediately downstream of the doffer cylinder 4. The cylinder 6 is supported by a structure 7 which is movable vertically relative to a fixed support structure, schematically indicated 8, between a lowered, working position in which the fins of the cylinder 6 are in contact with the web and a raised, rest position which allows the web to be positioned manually at the start of the operation.

[0012] The cylinder 6 is driven by its own variable-speed drive motor and rotates anticlockwise. The cylinder 6 accompanies and controls the web V_1 and conveys the air-flows produced by the rotating members, thus constituting an integral part of the conveyor system.

[0013] A flap 9 extending horizontally from the base of the movable structure 7 is disposed transversely relative to the initial active portion 5a of the conveyor 5 and is spaced a small vertical distance therefrom.

[0014] The flap 9 has the function of controlling the sudden change in atmospheric pressure which arises during the movement from the region in which the web V_1 is controlled by the rotating cylinders 2, 4 and 6 to the region in which the web is released onto the conveyor 5.

[0015] Between the horizontal active portion 5a and the inclined active portion 5b, the conveyor belt 5 portiones over a guide roller 10. A control cylinder, indicated 11, also having a closely-packed peripheral set of fins, acts on the web V_1 in the region of the guide roller 10.

[0016] An auxiliary conveyor belt which controls the path of the web V_1 on the inclined active portion 5b of the conveyor belt 5 is indicated 12. The conveyor belt 12 has an active portion 12a which is disposed adjacent the inclined portion 5b and is subject, centrally, to the action of a regulating roller 13.

[0017] The lower combing cylinder 3 takes a lower web of fibres from the swift 1 and orients them parallel to the direction of advance. The combing cylinder 3 cooperates with a doffer cylinder 4a which releases a lower web V_2 of fibres oriented parallel to the direction of advance onto a substantially horizontal conveyor belt 15.

[0018] A control cylinder 16 having a closely-packed peripheral set of fins acts on the conveyor 15 immediately downstream of the doffer cylinder 4a.

[0019] The cylinder 16 is supported by a structure 17 which is movable relative to a fixed support structure 8, in the same manner as described with reference to the control cylinder 6.

[0020] A flap 18 extends horizontally from the base of the movable structure 17. The functions performed by the cylinder 16 and by the flap 18 in relation to the lower web V_2 correspond to those performed by the cylinder 6 and the flap 9 in relation to the web V_1, as described above.

[0021] The web V_1 supplied by the inclined active portion 5b of the conveyor 5 is deposited on the web V_2 transported by the active portion of the lower conveyor 15, thus forming a web V_3 resulting from the superimposition of the two above-mentioned webs.

[0022] A control cylinder 19 acts on the web V_3 - in the vicinity of the region in which the two webs V_1, V_2 are superimposed; in the same manner as the above-described cylinders 6 and 16, the control cylinder 19 has a closely-packed peripheral set of fins and is supported by a structure 20 which is movable relative to a support structure 8 and from the base of which a transverse flap 21 extends horizontally.

[0023] The finned cylinder 19 and the flap 21 have the same functions in relation to the web V_3 as are performed by the cylinder 6 and by the flap 9 in relation to the web V_1 and by the cylinder 16 and by the flap 18 in relation to the web V_2.

[0024] The device described above produces webs which have fibres oriented parallel to the direction of advance and which are usable - after subsequent known operations for rendering them cohesive (calendering, needle-felting and resin-bonding) - in the production of strips for non-woven fabrics.

[0025] In the variant shown in Figure 2, parts in common with Figure 1 are indicated by the same reference numerals.

[0026] This variant differs from the embodiment shown in Figure 1 in that a randomizer cylinder 22, 24 which rotates clockwise is interposed between each combing cylinder 2, 3 rotating anticlockwise and the respective doffer cylinder 4, 4a, and in that each doffer cylinder 4, 4a also rotates clockwise.

[0027] The fibres are thus transported entirely on the upper portion of each randomizer cylinder 22, 24 and of each doffer cylinder 4, 4a.

[0028] Since the speed of the combing cylinders 2, 3 is much faster than that of the randomizer cylinders 22 and 24 which have clothings the tips of which are oriented in the opposite direction to those of the clothings of the combing cylinders 2 and 3, the fibre arriving tends to become entangled in the spirals of the clothings of the randomizer cylinders 22 and 24, accumulating and adopting a random arrangement.

[0029] The transportation of the randomly-arranged fibres from the randomizer cylinder 22 to the doffer cylinder 4 is controlled by a peripherally finned control cylinder 23 which cooperates with the cylinders 22 and 4 in order to accompany and control the web of fibres and to convey the air-flows produced by the rotation of these cylinders.

[0030] The control cylinder 23 is supported by an appendage 7a of the movable structure 7 which, as previously described, supports the control cylinder 6 and the flap 9.

[0031] In exactly the same way, the transportation of the randomly-arranged fibres from the randomizer cylinder 24 to the doffer cylinder 4a is controlled by a peripherally finned control cylinder 25 which cooperates with the cylinders 24 and 4a to accompany and control the web of fibres and to convey the air-flows produced by the rotation of these cylinders.

[0032] The control cylinder 25 is supported by an appendage 17a of the structure 17 which, as previously described with reference to Figure 1, supports the control cylinder 16 and the flap 18.

[0033] The embodiment shown in Figure 2 can produce webs of randomized fibres (that is, fibres distributed statistically in a random manner) which, after they have been rendered cohesive, can be used in the production of non-woven fabrics.

[0034] Figures 3 and 4 show a first embodiment of a peripherally finned control cylinder, that is, of one of the cylinders indicated by the reference numerals 6, 11, 16 and 19 in Figures 1 and 2 and by the reference

numerals 23 and 25 in Figure 2.

[0035] The control cylinder is generally indicated A and is constituted by a cylindrical tube 26 on which metal disks 27 are mounted radially with the interposition of annular metal spacers 28 having radial side walls. The assembly constituted by the disks 27 and the respective spacers 28 is clamped on the tube 26 by two ring nuts (not shown) which are screwed onto the threaded ends of the tube 26 and act on the two end spacers.

[0036] In operation, the cylinder A accompanies and controls the web and conveys the air-flows produced by the rotating members.

[0037] In the variant of Figures 5 and 6, a control cylinder B has a helical set of fins produced by the insertion and fixing of a thin metal strip 29 in a helical groove 30 formed in the surface of a metal cylinder or tube.

[0038] With a cylinder of this type, in addition to the two effects mentioned with reference to the cylinder A, an entrainment effect is also achieved on the surface of the web, in the direction of the screw thread.

[0039] In the variant illustrated in Figures 7 and 8, a finned control cylinder C is constituted by a cylindrical tube 32 on which metal disks 33 are mounted obliquely with the interposition of annular metal spacers 34 each having two inclined side walls which are parallel to one another.

[0040] The angle of inclination selected for the disks 33 is such that, as a result of a rotation of the cylinder C through 360°, the path travelled by the periphery of each disk 33 corresponds to the axial distance between two adjacent disks.

[0041] With the use of the cylinder C, in addition to the two effects mentioned with reference to the cylinder A, an entrainment effect with a reciprocating motion is also achieved on the surface of the web.

[0042] In the control cylinders B and C, the fins are not radial and, at high speeds, they thus generate an air-flow which, as a result of the presence of the flaps which are associated with these cylinders as described above, produces a slight pressure on the surface of the web which prevents detachment of the web in the spaces between the fins.

[0043] All of the finned cylinders described above are driven independently by means of variable-speed motors, so that they can also be used to bring about condensation or stretching effects on the web in transit.

[0044] A preferred embodiment of the movable structure indicated 7 and 7a in Figure 2, which supports the peripherally finned control cylinders 23 and 6 as well as the flap 9, will now be described with reference to Figures 9, 10 and 11.

[0045] In Figure 9, a movable structure, generally indicated 35, is in the form of a frame which supports the two control cylinders 23 and 6, both having peripheral fins.

[0046] As described above, the control cylinder 23 acts on the web in order to control the transportation, to the doffer cylinder 4, of the fibres arranged randomly in the randomizer cylinder 22, and the control cylinder 6 acts on the web downstream of the doffer cylinder 4 in order to control the supply of the fibres to the initial active portion 5a of the conveyor 5.

[0047] As shown in Figure 10, the frame-like movable support structure 35 is constituted by two longitudinal arms 36 and 37 which are connected at one end by a pin 38 by means of which the movable structure 35 is articulated about a horizontal axis relative to a fixed structure 39. The two arms 36 and 37 are connected to one another in the region of their ends remote from the articulation pin 38 by a box-sectioned sheet-metal cross-member 40. The lower portion 9 of the cross-member 40 is shaped so as to constitute a flap which, as described above, cooperates with the web which is released onto the initial active portion 5a of the conveyor 5 to reduce the adverse effects due to the sudden changes in pressure which arise at the web-release points.

[0048] The support structure 35 can be moved from the lowered working position, shown in solid outline in Figure 9, to a raised, rest position, shown in broken outline, by means of two flexible cables 41 (only one of which is visible in Figure 9), each of which is fixed, at one end, to the end of a respective longitudinal arm 36 and 37 remote from the articulation pin 38.

[0049] Each cable portiones over a guide pulley 42 and is connected to the rod 43 of a double-acting hydraulic jack 44 which is carried by the fixed structure 36. When the movable support structure 35 is in the raised, rest position, it is possible to position the web manually at the start of the operation.

[0050] To ensure precise positioning and clamping of the movable structure 35 in its working position, the fixed structure 39 carries - as shown in Figure 10 - two pneumatic jacks 45, 46 the movable rods of which are engaged in corresponding holes 47 in the outer ends of the two longitudinal arms 36, 37 when the movable structure 35 is in the lowered, working position. One of these holes 47 is visible in Figure 11.

[0051] When the movable structure 35 is in the raised position, the above-mentioned two holes 47 are engaged by a second pair of pneumatic jacks 45a, 46a, which lock the structure 35 in this raised position. The operation of the above-mentioned pneumatic jacks in each of the two positions of the support structure 35 is brought about by position-sensor devices of known type.

[0052] The peripherally finned control cylinders 23, 6 are rotated by respective variable-speed motors, indicated 49 and 50. The cylinders 23 and 6 are also supported by the movable structure 35 in a manner such that their positions relative to the structure can be adjusted both vertically and horizontally.

[0053] For this purpose, each of the two end pins 51 of each cylinder 23, 6 is engaged in a hole 52 formed in the lower portion of a support plate 53 which has an

upper horizontal slot 54. Each plate 53 is housed in a recess 55 of greater width which is formed in the outer wall of the respective longitudinal arm 36, 37 and which has a vertical slot 56. A screw 57 extends through the horizontal slot 54 of each plate 53 and the vertical slot 56 of the respective recess 55.

[0054] The screw 57 is locked by means of a nut 58 which reacts against the inner surface of the respective longitudinal arm 36, 37 in order to clamp the plate 53 in the recess 55 in the position corresponding to the desired position of the pin of the respective control cylinder. The plate 53 is prevented from moving, after the screw 57 has been locked, by a vertical stop screw 59 which engages the upper face of the plate 53 and by a horizontal stop screw 60 which engages one of the side faces of the plate 53.

[0055] Naturally, the plate 53 could have a vertical slot and the recess 55 could have a horizontal slot.

[0056] A similar device is used for adjusting the position of the cross-member 40, and hence of the flap 9, both vertically and horizontally relative to the movable support structure 35.

[0057] For this purpose, each of the ends of the box-sectioned cross-member 40 is connected to a plate 53a, the position of which is adjustable in the same manner as described above, in a recess 55a of the respective longitudinal arm 36, 37 by means of a clamping screw 57a, a vertical stop screw 59a and a horizontal stop screw 60a.

[0058] The foregoing description of an embodiment of the movable structure which supports the cylinders 6 and 23, and which is indicated 7 and 7a in Figure 2, also applies to the identical structure which supports the cylinders 16 and 25 and which is indicated 17 and 17a in Figure 2.

[0059] It also applies to the movable structures indicated 7, 17 and 20 in Figures 1 and 2, each of which supports a single finned control cylinder, indicated 6, 16 or 19, respectively. In the case of these structures, it suffices, in fact, to adapt the movable structure 35 described above to render it suitable for supporting a single control cylinder instead of two.

Claims

1. Carding apparatus, particularly for preparing webs for non-woven fabrics, of the type comprising:

   - two output combing cylinders (2, 3) disposed at different heights and cooperating with the final swift (1) of the carding apparatus in order to pick up an upper web of fibres (V_1) and a lower web of fibres (V_2), respectively,

   - an upper doffer cylinder (4) which supplies the upper web (V_1) to an upper conveyor belt (5) having a substantially horizontal initial active portion (5a) and a downwardly-inclined final active portion (5b),

   - a lower doffer cylinder (4a) which supplies the lower web (V_2) to a substantially horizontal lower conveyor belt (15) onto which the upper web (V_1) is also supplied by the inclined final active portion (5b) of the upper conveyor belt (5) in order to be superimposed on the lower web (V_2),

   characterized in that it comprises a plurality of peripherally finned control cylinders (6, 16, 11, 19) each of which is driven by its own variable-speed motor, the finned control cylinders comprising:

   - a first finned control cylinder (6) which acts on the horizontal active portion (5a) of the upper conveyor belt (5) adjacent the doffer cylinder (4) which supplies the first web (V_1),

   - a second finned control cylinder (16) which acts on the lower conveyor belt (V_2) adjacent the doffer cylinder (4a) which supplies the second web (V_2),

   - a third finned control cylinder (11) which acts on the end portion of the substantially horizontal active portion (5a) of the upper conveyor belt (5),

   - a fourth finned control cylinder (19) which acts on the lower conveyor belt (15) immediately downstream of the region in which the first web (V_1) is deposited on the second web (V_2).

2. Carding apparatus according to Claim 1, in which randomizing means are interposed between each output combing cylinder (2, 3) and the respective doffer cylinder (4, 4a), characterized in that the randomizing means are constituted by a single randomizer cylinder (22, 24), and in that there are also provided:

   - a fifth peripherally finned cylinder (23) which cooperates with the randomizer cylinder (22) and with the doffer cylinder (4) which act on the first web (V_1),

   - a sixth finned control cylinder (25) which cooperates with the randomizer cylinder (24) and with the doffer cylinder (4a) which act on the second web (V_2).

3. Carding apparatus according to Claims 1 and 2, characterized in that each finned control cylinder (23, 6, 11, 25, 16, 19) has thin, closely-packed peripheral fins (27, 29, 33).

4. Carding apparatus according to Claim 3, characterized in that each finned cylinder (A) is constituted by a cylindrical tube (26) on which metal disks (27) are mounted radially with the interposition of annular spacers (28) having radial side walls.

5. Carding apparatus according to Claim 3, characterized in that each finned cylinder (C) is constituted by a cylindrical tube (32) on which metal disks (33) are mounted obliquely with the interposition of annular metal spacers (34) having side walls with the same inclination.

6. Carding apparatus according to Claim 3, characterized in that each finned cylinder (B) has a helical set of fins (29).

7. Carding apparatus according to Claim 6, characterized in that the helical set of fins is produced by the insertion and fixing of a thin metal strip (29) in a helical groove (30a) formed in the surface of a metal cylinder (30).

8. Carding apparatus according to Claim 1 or claim 2, characterized in that each of the first, second and fourth finned cylinders (6, 16, 19) is supported by a movable structure (7, 17, 20) which is movable relative to a fixed support structure between a lowered, working position and a raised, rest position, and in that a flap (9, 18, 21) directed transverse the direction of advance of the respective web (V_1, V_2, V_3) extends horizontally from the base of each of these movable structures and acts as an element for controlling the air pressure which acts on the web.

9. Carding apparatus according It Claim 8, when dependent on Claim 2, characterized in that the first finned control cylinder (6), the flap (9) situated downstream of the cylinder (6), and the fifth finned control cylinder (23) are supported by the same movable structure (7, 7a), and in that the second finned control cylinder (16), the flap (18) situated downstream of the cylinder (16), and the sixth finned control cylinder (25) are supported by the same movable structure (17, 17a).

10. Carding apparatus according to Claim 1, characterized in that an endless, auxiliary conveyor belt (12) cooperates with the downwardly-inclined active portion (5b) of the upper conveyor belt (5), the active portion of the auxiliary belt (12) adjacent said inclined portion being subjected centrally to the action of a regulating roller (13).

11. Carding apparatus according to Claim 1, characterized in that the fibres are transported from the swift (1) to each of the doffer cylinders (4, 4a) entirely on the lower portion of each combing cylinder (2, 3) and of each doffer cylinder (4, 4a).

12. Carding apparatus according to Claim 2, characterized in that the fibres are transported from each combing cylinder (2, 3) to each of the doffer cylinders (4, 4a) entirely on the upper portion of each randomizer cylinder (22, 24) and of each doffer cylinder (4, 4a).

13. Carding apparatus according to Claims 8 and 9, characterized in that each movable structure (7, 17, 20; 7-7a, 17-17a) is constituted by a frame (35) comprising two longitudinal arms (36, 37) which are connected, at one end, by a pin (38) articulated about a horizontal axis relative to a fixed structure (39) and, at the opposite end, by a cross-member (40) the lower portion of which is formed so as to constitute the above-mentioned flap (9, 18, 21), the longitudinal arms (36, 37) having supports (53) for the end pins of the respective control cylinders (6, 16, 19, 23, 25), and drive means (41, 42, 43, 44) being provided for causing each frame (35) to pivot about the horizontal axis of the respective pin (38) between the above-mentioned lowered, working position and the above-mentioned raised, rest position.

14. Carding apparatus according to Claim 13, characterized in that it comprises locking means (45, 46, 47, 48) for locking the frame (35) both in its lowered, working position and in its raised, rest position.

15. Carding apparatus according to Claim 14, characterized in that the locking means are constituted by two pairs of pneumatic jacks (45, 46; 45a, 46a) the rod of each jack being able to engage a corresponding hole (47) of the longitudinal arms (36, 37).

16. Carding apparatus according to Claim 15, characterized in that the means which bring about the pivoting of each frame (35) are constituted by a pair of hydraulic jacks (44) the rods (43) of which are connected, by means of respective cables, to the ends of respective longitudinal arms (36, 37) remote from the articulation pin (38) of the frame (35).

17. Carding apparatus according to Claim 13, characterized in that it comprises means for regulating, vertically and horizontally, relative to the longitudinal arms (36, 37), both the positions of the finned control cylinders (6, 16, 19, 25, 26) and the position of the cross-member (40) the lower portion of which constitutes the flap (9, 18, 21).

18. Carding apparatus according to Claim 17, characterized in that the regulating means comprise support plates (53, 53a) housed in respective recesses

(55, 55a) of greater width formed in the outer portions of the longitudinal arms (36, 37), each support plate having a horizontal (54) or vertical slot, and the respective recess (55) having a vertical (56) or horizontal slot, a screw (57) extending through the two slots (54, 56) and clamping the plate (53, 53a) against the base of the respective recess (55,55a), the plate (53, 53a) being prevented from moving by two stop screws (59, 60; 59a, 60a) of which one (59, 59a) engages a horizontal face of the plate (53, 53a) and the other (60, 60a) engages a vertical face of the plate (53, 53a).

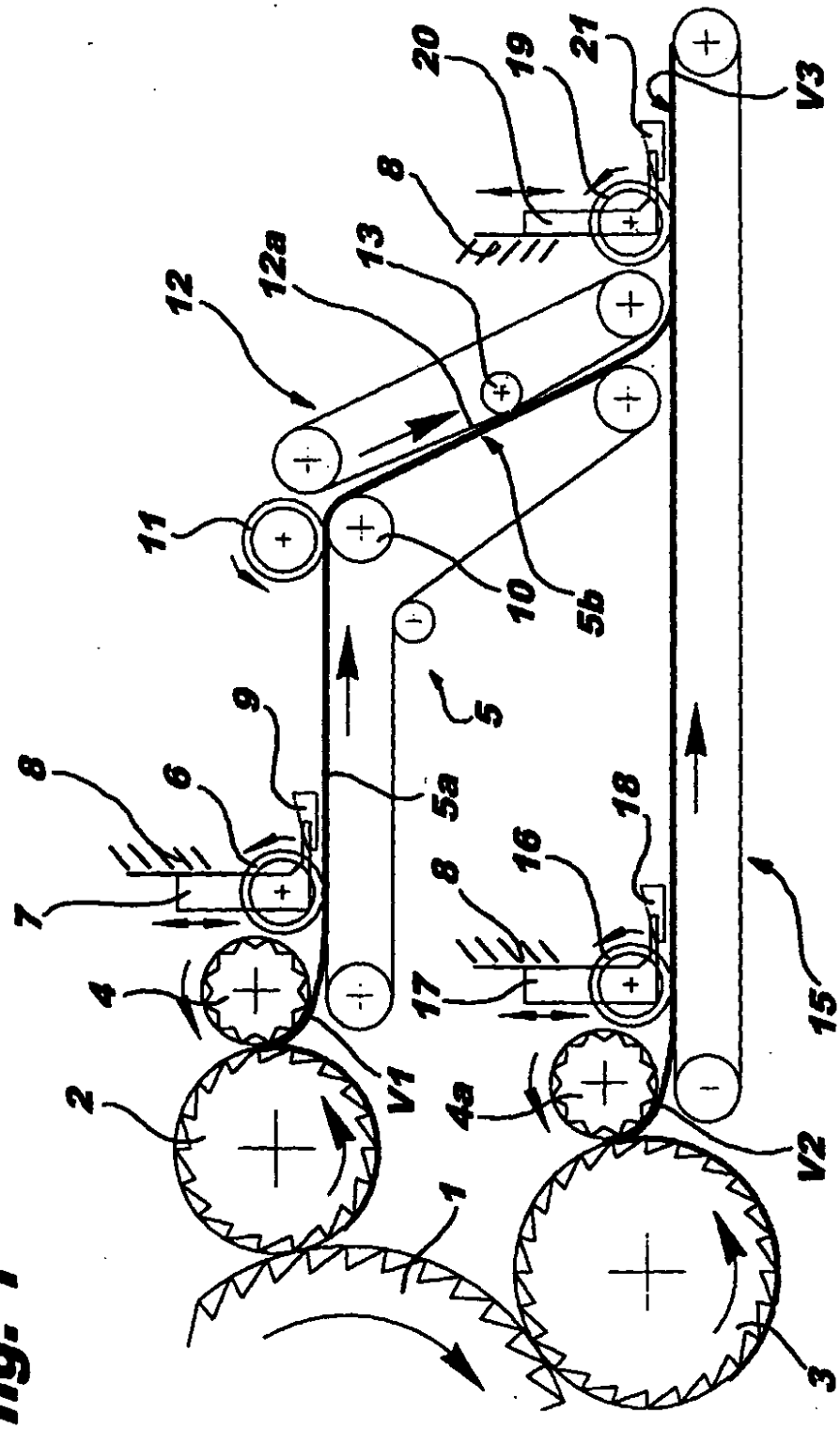

fig. 1

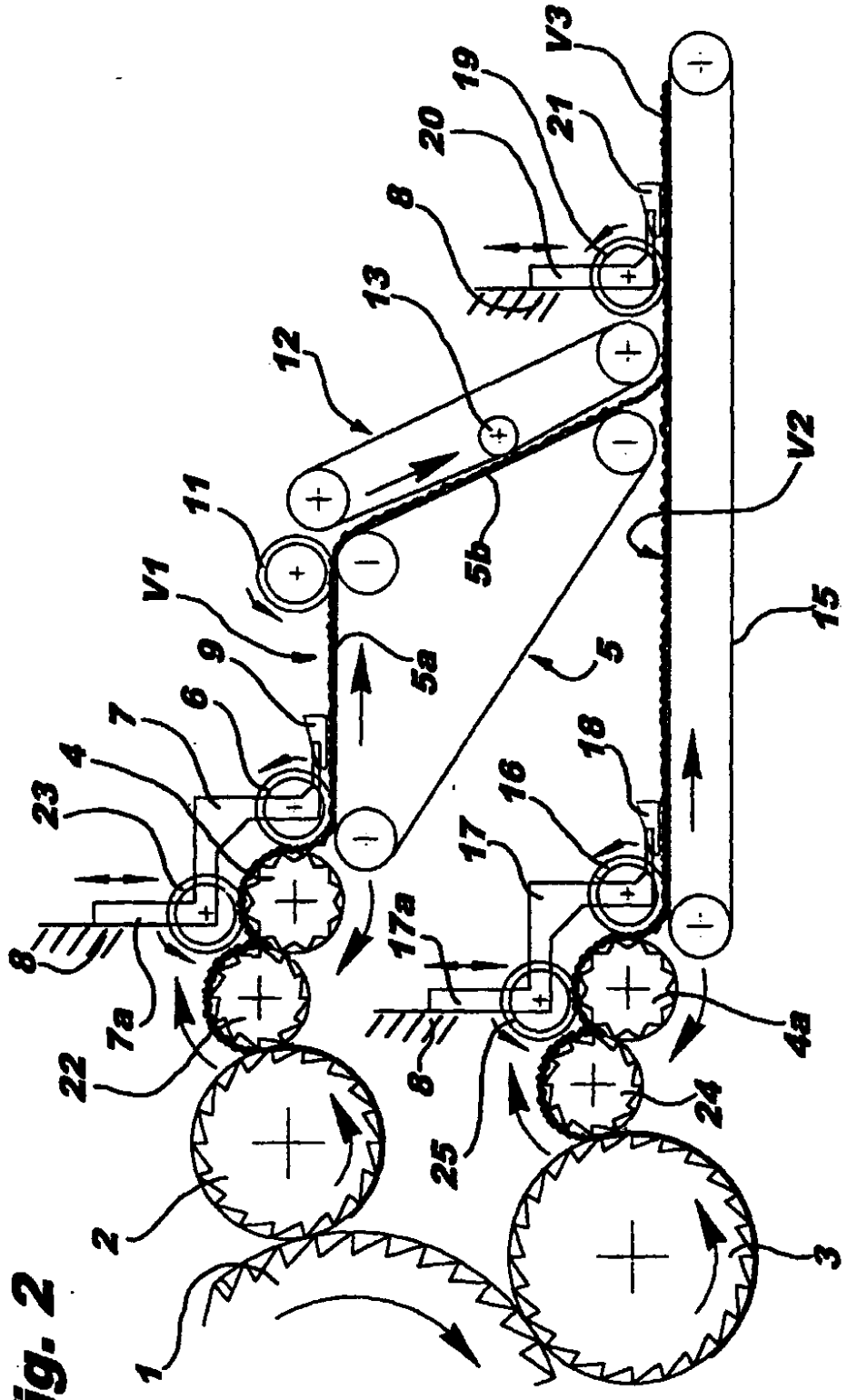
V3
19
21
20
8
13
12
V2
11
5b
V1
5a
5
15
9
6
7
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fig. 2

fig. 3

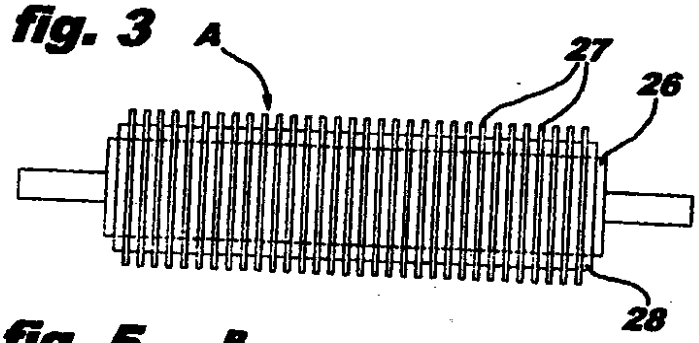


fig. 4

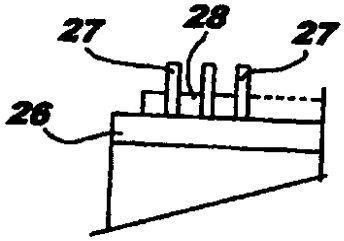


fig. 5

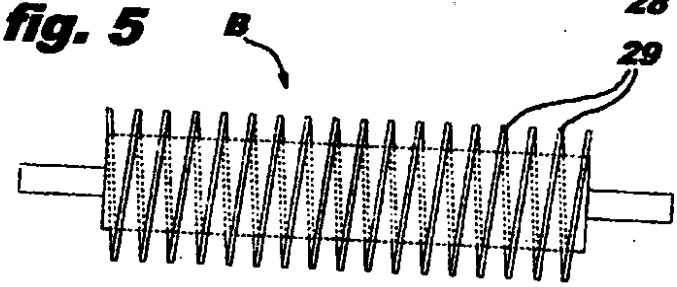


fig. 6

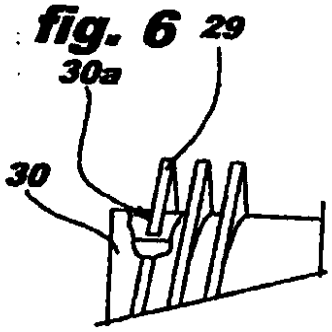


fig. 7

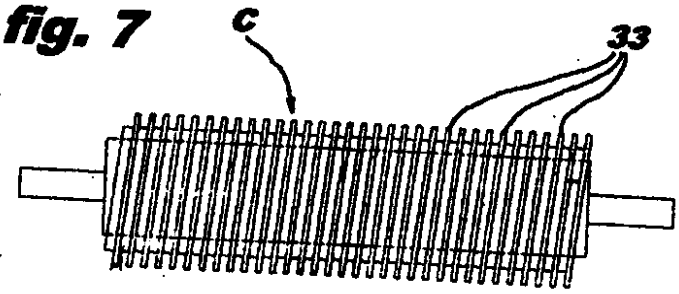


fig. 8

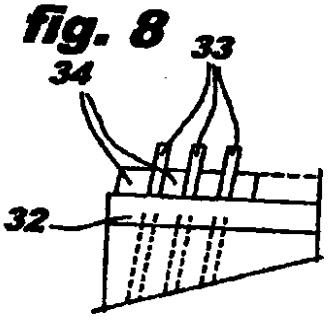
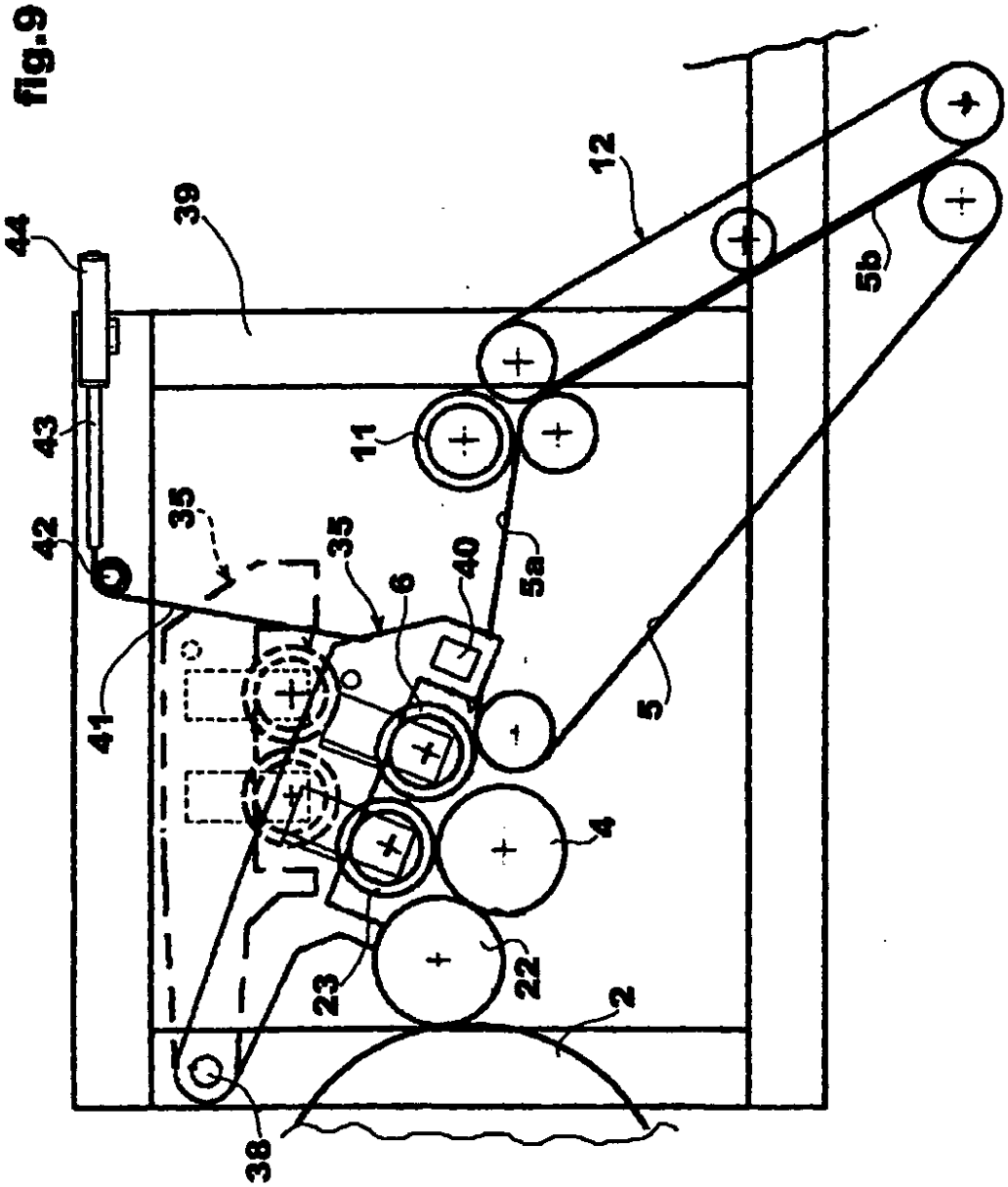


Fig.9



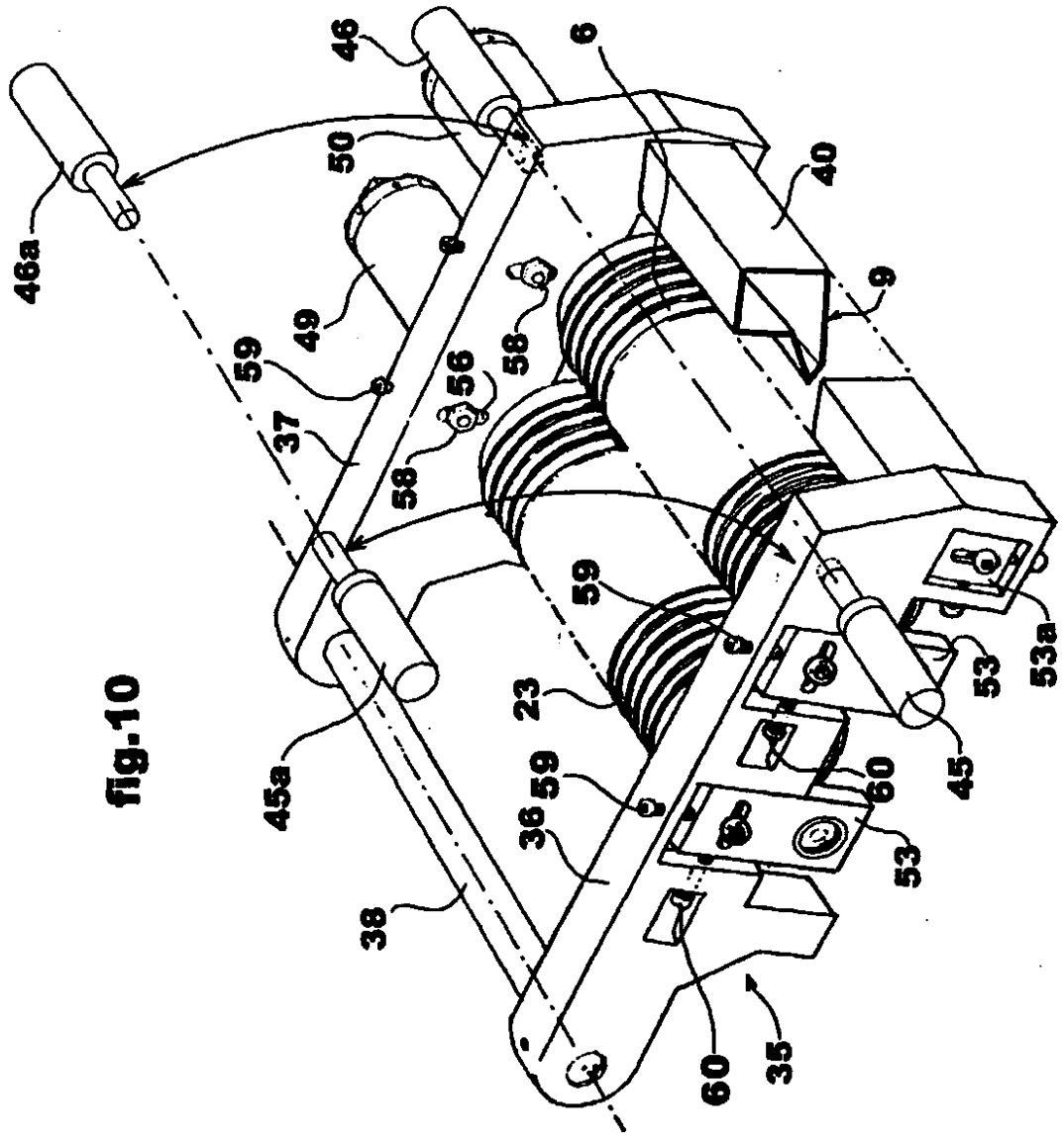

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fig.10

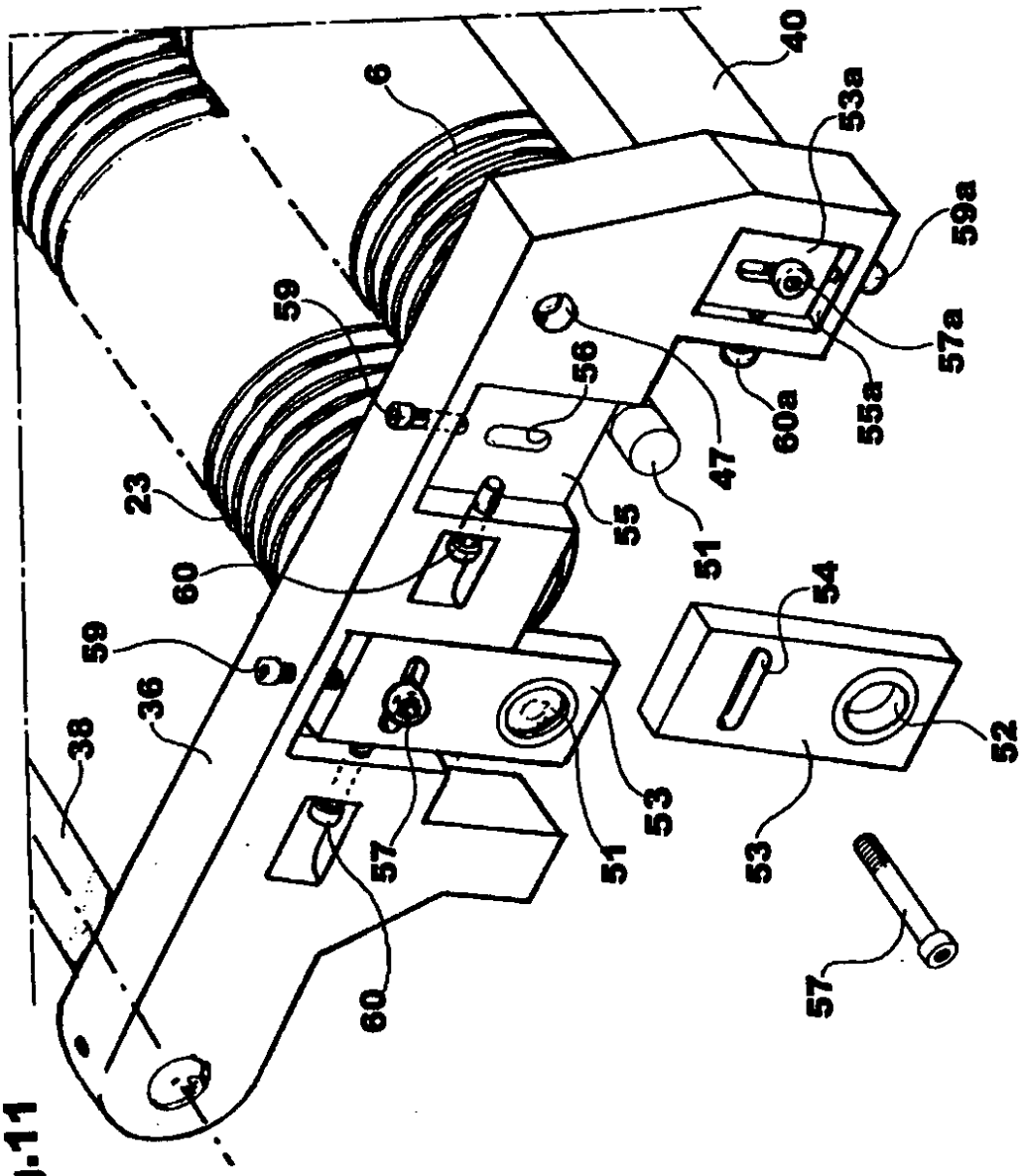
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fig.11

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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 8417

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 July 2000	Munzer, E

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